

STATE OF CALIFORNIA
AIR RESOURCES BOARD

QUALITY ASSURANCE
VOLUME II

STANDARD OPERATING PROCEDURE
FOR
AIR QUALITY MONITORING

APPENDIX R
XONTECH 920

MONITORING AND LABORATORY DIVISION

JUNE 1991

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APPENDIX R.1.0
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R.1.0 GENERAL INFORMATION

R.1.0.1 THEORY OF OPERATION

The Model 920 Toxic Air Sampler is designed for the unattended collection of ambient air samples on a variety of filter materials (37 or 47 millimeter) and solid sorbent tubes for laboratory analysis of toxic compounds. The sampler is modular in design such that eight individually controlled sampling channels can be readily installed. The sampler precisely controls the sampling time and the flow rate through each sampling head using a microprocessor and mass flow controller.

The Model 920 sampler is comprised of three assemblies: the Pump Assembly, the Control Assembly, and the Sampling Assembly. The three assemblies are illustrated in the system block diagram, Figure R.1.0.1, and the sample flow through the system is illustrated in Figure R.1.0.2.

The Pump Assembly contains the Gast Model 1022-V103 rotary vane vacuum pump and a solid state relay, which allows the pump to be switched by the microprocessor. The pump assembly has control circuitry, plumbing, and space to add a second low-volume vacuum pump. The Control Assembly contains the microprocessor, flow control modules, control panel (keyboard, printer, and display), and measurement electronics. The Sampling Assembly can accommodate up to eight sampling modules, each containing a slider valve, driver motor, and sampling media holder. Two types of sampling media can be utilized: one that uses solid sorbent sampling tubes and one that uses 37 or 47 millimeter filters. Because of the flow capacity, a maximum of four 47-millimeter filters and four sampling tubes may be operated simultaneously.

The sampler must be leak checked and calibrated before operation. To operate the sampler, the operator changes the sample number and sets the start and stop time through the control panel. When the microprocessor clock reaches the indicated start time, the software sends a signal to start the pump. The microprocessor actuates the motor to open the slider valve in the sampling module, and then it opens the solenoid valve of the flow control module. The mass flow controller regulates the flow according to the set point, which is selected via the thumbwheel switch on the flow module. The 0 to 5VDC flow signal from the MFC is proportional to the flow and is monitored by the microprocessor. The processor monitors the flow four times per minute for the duration of the sampling period.

At the end of the sampling period, a report is printed which indicates the total volume of air which passed through the sampling device.

NOTE: For clarity, the three major components of the sampler are termed assemblies. Removable sub-assemblies for each sampling channel are termed modules. This terminology differs from that used in the manufacturer's manual.

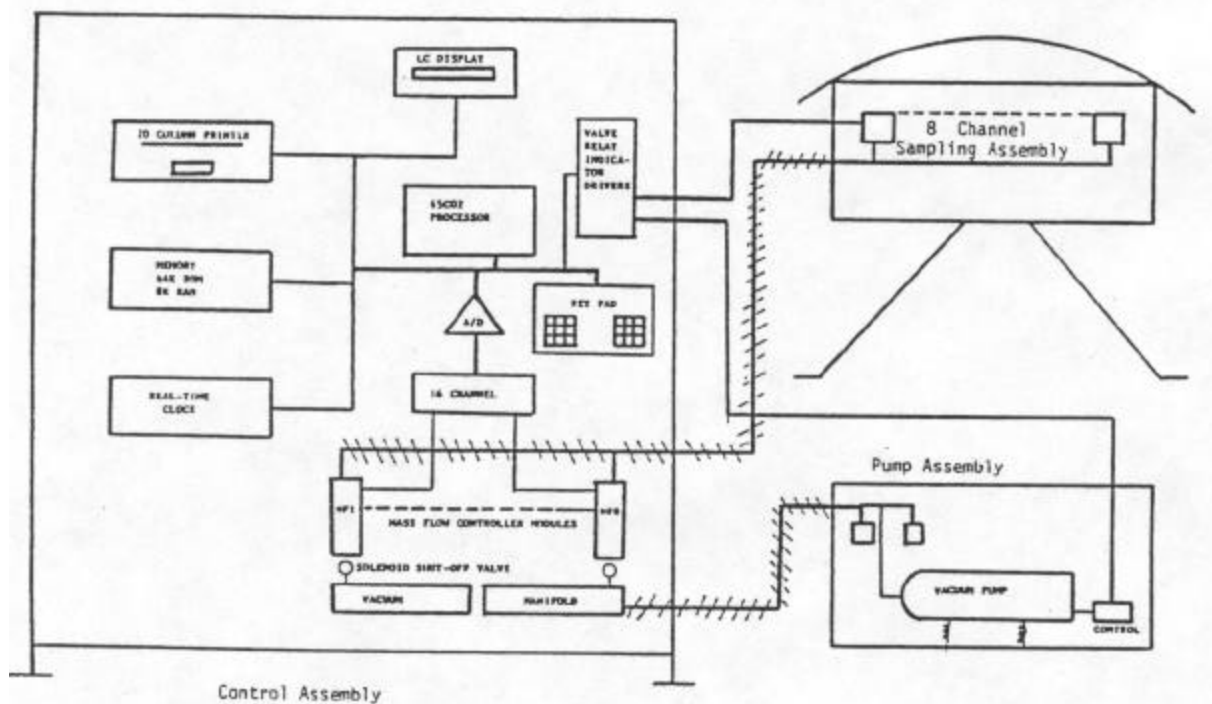


Figure R.1.0.1
System Block Diagram

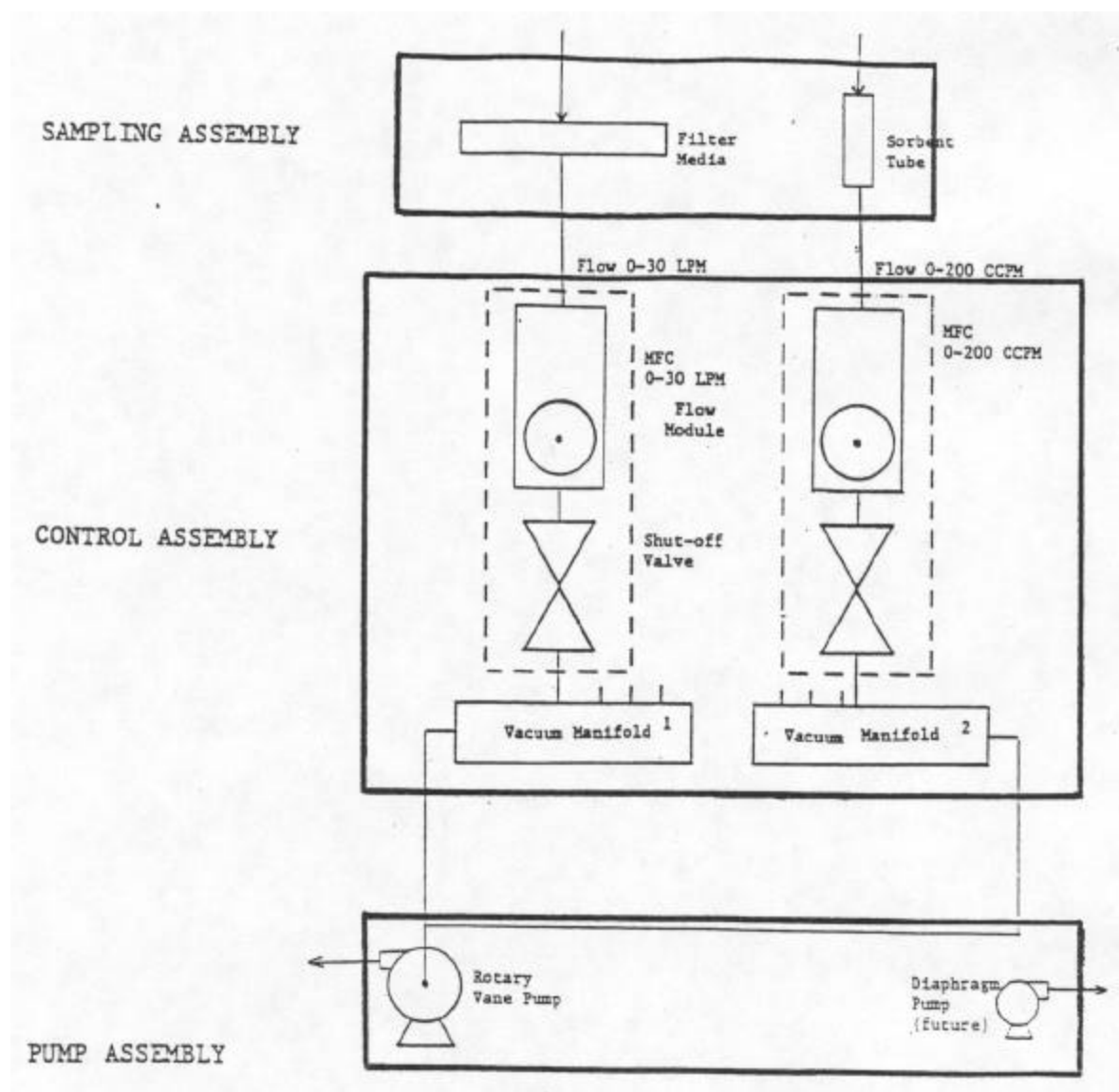


Figure R.1.0.2
Flow Diagram-920 Air Sampler System

R.1.1 INSTALLATION PROCEDURE

R.1.1.1 PHYSICAL INSPECTION

Unpack the sampler components from each carton and examine them carefully for evidence of shipping damage or rough handling. Verify that the sampler is complete upon receipt and check for loose or damaged components. If components are found damaged, notify your supervisor for appropriate action.

R.1.1.2 INITIAL START UP

1. Assemble the Sampling Assembly by installing the three legs in the leg sockets. Install the legs with the feet facing outward and tighten the retaining screws with a large slot type screwdriver.
2. Install the sample modules as follows:
 - a. Select the channels on which to install the sample modules. Filter modules must be installed on channels 1 to 4, while absorption tube modules can be installed on any channel. The channels are numbered on the sample support and corresponding numbers may be found on labels attached to tubing and the flow module mounts.
 - b. Place the top of the sample module into the slot on top of the sample support.
 - c. Start both knurled knobs of the holder into the support by hand and then tighten with a screwdriver.
 - d. Remove the plastic cap from the Swagelok fitting.
 - e. Connect the short (approximately 8 in. long) tube to the Swagelok fitting so that the metal tab on the quick disconnect fitting is pointing down. Tighten the fitting finger tight and then tighten it 1/4 turn with a wrench.
 - f. Install a filter holder or absorption tube holder in the sample module as applicable.

- g. Slide the quick connect onto the filter holder or absorption tube holder until it snaps into place.
 - h. Loop the electrical connector through the back of the sample support and connect it to the connector directly below and closest to the sampling holder for that channel.
- 3. Install the weather shield, used to protect the sampling modules, as follows:
 - a. Remove the weather shield from the shipping container.
 - b. Slide the weather shield down over the sample support with the slotted stanchions going between the two tabs.
 - c. Screw the bolts in with the large black knobs through the slots of the weather shield into the support. Place a black spacer on either side of the stanchion.
 - d. Tighten the weather shield in place.
- 4. Install the legs on the Control Assembly as follows:
 - a. Remove the Control Assembly and legs from the shipping container.
 - b. Open the assembly and make sure that all components are secure. Remove any loose components.
 - c. Attach the two legs to the assembly using the supplied screws. Be careful to avoid scratching the painted surfaces.
 - d. Place the unit upright and within eight feet of the Sampling Assembly. Make sure the cables and tubing will reach.
 - e. Secure the unit so the wind will not blow it over.

5. Install any additional sampling channels required as per Section R.1.1.3.
6. Locate the Pump Assembly within eight feet of the Control Assembly and within eight feet of a 110 VAC power source. This assembly has two cables which are captive to the box. One is the power cable to the entire assembly and one is the power cable to the Control Assembly.
 - a. Remove the pump box from the shipping container.
 - b. Remove the connecting tubing from inside the pump box.
 - c. Close the pump box lid and secure the latches.
7. Complete the installation of the sampler by interconnecting the three assemblies as follows:
 - a. Remove the plastic caps from the rear of the Control Assembly.
 - b. Connect the eight tubes from the Sampling Assembly to the rear of the Control Assembly. Be sure that each channel tube is connected to the appropriate channel. Each tube is labeled from the right showing channels 1-8. Finger-tighten the Swagelok connection and tighten each fitting 1/4 turn with a wrench.
 - c. Remove the plastic caps from the pump box.
 - d. Connect two tubes to the pump box. One is 1/4 inch O.D. and the other is 3/8 inch O.D.
 - e. Connect the other end of the tube to the lower fittings on the Control Assembly. Hand-tighten each fitting and then tighten it 1/4 turn with a wrench.
 - f. Unscrew the protective covers from both electrical connectors on the Control Assembly.
 - g. Open the Control Assembly and make sure the power is off. Power button down; push on the bottom of the button.

- h. Connect the yellow cable from the pump box to the right rear of the Control Assembly (looking from the back).
- i. Connect the power cable from the Sampling Assembly to the large connector on the left rear of the Control Assembly.
- j. Check all tubes and electrical connections for proper connection, and that the power is off at the Control Assembly.
- k. Connect the power cable to 110 Volt, 15 amp dedicated circuit.

R.1.1.3 ADDING ADDITIONAL CHANNELS

When an additional flow channel is installed, it will be necessary to install the sample holder, the flow module and the AC solid state relay. Follow these steps:

- 1. Install the Sample Holder as described in Section R.1.1.4.
- 2. Install the Flow Module as described in Section R.1.1.5.
- 3. Install the Solid State Relay as described in Section R.1.1.6.

R.1.1.4 INSTALLING AN ADDITIONAL SAMPLE HOLDER

The following steps are necessary when an additional sample holder is installed:

- 1. Remove the plastic cap from the bulkhead tubing connection for the channel of interest on the Control Assembly.
- 2. Connect the 3/8" or 1/4" tubing with the quick disconnect. Tighten the nut finger tight, and then tighten it 1/4 turn with a wrench, making sure the quick connect is easily depressed. (It should face you when held in a vertical position.)
- 3. Place the sample holder tab into the slot on top of the support. Start both captive screws before tightening them.
- 4. Install the filter or tube holder.

5. Attach the quick connect to the filter holder or to the tube holder.

R.1.1.5 INSTALLING AN ADDITIONAL FLOW MODULE

The following steps are necessary when an additional flow module is installed.

1. Turn off the power.
2. Depress the metal tab on the quick connect and remove the plug from the channel of interest.
3. When installing additional modules for the first time, it is necessary to remove the metal retaining clip from the quick connect female coupler located on the manifold in the Control Assembly. If the retaining clip is engaged with the flow module in place, it will be very difficult to remove the flow module.

To remove the retaining clip, do the following:

- a. Depress the tab slightly to allow movement of the spring-loaded pin.
- b. Using a stiff wire or tool, e.g., a straightened wire paper clip, depress the spring-loaded pin so that it will slide under the metal retaining ring.
- c. Carefully release the pressure on the tab and hold a thumb over the pin so that it is not ejected with spring.
- d. Remove the metal pin and its spring and remove the metal retainer and its spring.

NOTE: These metal retainers were left on the quick connects to keep the plugs from falling out during shipment. The system will run without them because the vacuum will hold them in place.

4. Remove the plastic cap from the bulkhead fitting, which extends through the Control Assembly.

5. Attach the seven-inch tube to the bulkhead fitting. Tighten fitting finger tight and tighten it 1/4 turn with a wrench.
6. Remove the plastic cap from the flow module and inspect to ensure the screen is present.
7. Connect the flow module to the seven-inch tube. Tighten the fitting finger tight and tighten it 1/4 turn with a wrench.
8. Push the control module in so that it mates with the quick connect and tighten the 4 screws with a screwdriver.
9. Connect the electrical connections to the appropriate channel positions: the 9-pin connector to J1 to J8 and 2-pin connector to A2J1-A2J8.
10. Turn on the power.

R.1.1.6 INSTALLING ADDITIONAL CHANNEL SOLID STATE RELAYS

1. The solid state relay circuit board (PB8) is located above the vacuum manifold in the Control Assembly. Installation or replacement of the OAC5 solid state relays may require removal of flow modules one to four in order to gain access to the circuit board.
2. Open the control panel and lock in horizontal position.
3. Remove flow modules one to four if necessary to gain access to PB8.
4. Install the OAC5 solid state relay in the PB8 in the appropriate channel. Push the relay into the socket and tighten the Phillips screw.
5. Replace any flow modules that were removed, return control panel to vertical, and lock panel in place with knurled screws.

R.1.2 OPERATION

R.1.2.1 START UP

Start up is divided into two sections: **Cold Start and Warm Start**. A cold start is needed when there is a memory battery change with power off or a desire to zero all values in memory.

The cold start does not affect the clock or its time. The clock has its own battery and will keep accurate time when the power is off.

A warm start will occur each time there is a power failure or the power is turned off. The memory has its own battery and retains the program when the power is off.

R.1.2.2 COLD START

System initiation takes place each time the system is restarted. This allows the computer to know the position of each valve. This initiation will open all slider valves, close all slider valves, and then set up the system as programmed.

A cold start is performed as follows:

CAUTION: When a cold start is performed, up to four slider valves can be open. The cold start will cause all open valves to close and the power supply can drive only four valves at a time. If more than four valves are open, it is necessary to disconnect those in excess of four valves temporarily. To do this, pull the plug that connects the sample holder to the sample support until the initiation cycle is complete (time is displayed). Plug these channels in and then use SLIDER TEST to close the valves.

1. With the power OFF, hold down the **ENTER** key and turn the power ON. Hold the key down and watch the display carefully until you see the display quickly flash "PRINTER READY".
2. Release the **ENTER** key.

3. Wait 90 seconds while the system is initiated, then the time should be displayed as:

TIME HH:MM DDD

(where HH is hour, MM is minute, and DDD is the Julian day). If the time is not displayed as described, repeat Steps 1-3.

4. Push **STEP** to examine the station number. **There should not be a** station number. If there is a station number, turn off the power and repeat Steps 1-4.
5. Enter the STATION NUMBER.
6. Enter the TIME.
7. Select Channel 11 by pushing **CHANNEL MENU**, then **11**.
8. Push **ENTER** to enter Channel 11 menu.
9. Push **BACKSTEP** four times to display:

11 SLOPE 0.00

10. Enter 100 as the slope by pushing **SET 100** followed by **ENTER**.
11. Examine the value; it should read:

11 SLOPE 100.00

If not, repeat Step 10.

12. Push **SYSTEM MENU** until the TIME appears on the display.
13. Push **STEP** two times to show:

CONTROL BOX XX.X C

The value XX.X should read approximately 25.0° C. This will vary depending on the ambient temperature.

NOTE: There must be a mass flow meter plugged into one of the channels in order to display temperature or voltages properly.

14. Install samples and operate the system as described in Section R.1.2.5.

R.1.2.3 WARM START

A warm start is performed automatically each time the system is turned on without the ENTER key depressed. The following may be expected:

1. The system initiation will be performed.
2. The system will flag any busy channels with a power failure time.
3. Any channels, which have a stop time less than the power fail time will begin to print their reports.

NOTE: If the display does not display the time and the printer runs but does not print, perform a cold start.

4. Sample times will not be changed.
5. Channels in use will turn “ON”.
6. After 10 seconds, the printer will print “READY”.

Operator actions are not required with a warm start. The system will usually run automatically when power comes on after a power outage.

R.1.2.4 SAMPLING FREQUENCY

The present 12-day sampling schedule is exhibited as Figure R.1.2.1.

R.1.2.5 PRE-RUN PROCEDURE

All filters and sorption tubes are prepared in the laboratory and must be given a unique sample number. The operator at the field site collects the sample and returns it to the lab for analysis.

1. The sample program must be modified before a sample can be run. Open the Control Assembly door, which exposes the front panel. The indicator light for each channel will indicate if any channel is currently in operation. A label for each flow module shows the corresponding channel number.
2. Determine the correct channel to be programmed. Enter that channel number to begin the channel programming sequence. See Figure R.1.2.2 for Channel Control Guide or pages 25-41 of the Operations Manual for programming details.
3. Enter the SAMPLE NUMBER.
4. **STEP** to the START TIME and, if necessary, set the start hour, minute, and Julian day.
5. **STEP** to the STOP TIME and, if necessary, set the stop hour, minute, and Julian day.
6. If necessary, set the sample flow rate using the digital switches on the flow control module to the appropriate setting based on the MFC calibration (see Section R.3).
7. Ensure that the Channel is ON LINE. (See page 58 of the Operations Manual for help). Confirm that the data has been entered correctly. To PRINT a copy of the channel program, push **PRINT OPTIONS MENU** and **STEP** to the desired channel, then press **PRINT**.
8. If you observed any irregularities in channel operation, examine the channel program for the following:

START time, STOP time, SLOPE, INTERCEPT DAYS/CYCLE and ONLINE. SCANS, SMPL TIME, STFLOW and VOLUME should be zero. Fix any errors by re-entering data.

R.1.2.6 CHANGING FILTER SAMPLES

1. If necessary, swing the weather shield of the Sampling Assembly out of the way by loosening the two large knobs on either side of the shield. Lift the shield up and swing it to the side away from where you want to work.

CAUTION: Do not get your fingers in the slider valves. If one should close on your finger, you can push it open.

NOTE: The slider valve of the channel which is being changed should be closed. On operating channels, the sliders will be open.
2. Push in on the metal tab of the quick disconnect on the channel of interest and pull down. The plastic quick connect will be removed from the filter holder.
3. Unscrew the bottom of the filter holder, being careful not to drop the filter. See Figure R.1.2.3 for an Exploded View of the Filter Holder.
4. If present, remove the used filter cassette and place it in its numbered container for return to the laboratory for analysis.
5. Wipe all dirt from the support screen, O-ring, face plate, and rubber gasket.
6. Be sure O-ring and support screen (fine grid side up) are in place and undamaged.
7. Remove the new filter cassette from its numbered container and place it on the O-ring, making sure that it is seated properly and that the cassette is placed so that the filter is next to the support screen.
8. Ensure that the rubber gasket is in place on top of the cassette, and screw this assembly with cassette in place, up into the holder. Do not over tighten or a torn filter may result.

9. Push in the metal tab on the quick connect and slide it on to the filter holder.
10. Record the filter number on the filter box or shipment envelope and toxics log sheet.
11. Swing the weather shield back to its horizontal position and slide it down to its stop.
12. Tighten the two large knobs.
13. The Model 920 is now ready for automatic operation.

R.1.2.7 CHANGING SORPTION TUBES

NOTE: The SEP-PAK cassette contains a skin irritant. Handle with care.

1. Install the sorbent tube cassette assembly in the XonTech 920 sampling head (See Figure R.1.2.4) as follows:
 - a. Position the weather shield to one side of the Sampling Assembly to provide access to the sampling heads.
 - b. Remove the metal cassette holder from the sampling head by disconnecting the quick disconnect tubing fitting and turning the cassette holder counterclockwise (CCW) to "unscrew" it from the sampling heads.
 - c. Remove the used SEP-PAK cassettes if applicable, cap the ends with the yellow caps provided, seal the SEP-PAK cassettes in the glass culture tube, place the culture tube in the aluminum cylinder, seal, and then place it in the cardboard shipping container and cap container.

NOTE: If the rubber gasket comes out with the SEP-PAK, re-insert gasket in sampling module.

- d. Remove the new SEP-PAK cassettes from the shipping containers (cardboard tube, aluminum tube, and glass culture tube), remove the yellow caps, and return the yellow caps to the glass culture tube.
- e. Check the sorbent tube cassette assembly to ensure all the connections are intact.
- f. Insert the short end of the sorbent tube into the red rubber gasket inserted in the sampling head. (The SEP-PAK with the smallest identification number should be on top).

NOTE: The gasket must be in place to properly seal the sample flow stream. Install a new gasket if none is in the sampling head.

- g. Reinstall the metal cassette holder on the sampling head by turning it clockwise (CW) to screw it into the sampling head, finger tight only.
- h. Reinstall the tubing quick disconnect onto the cassette holder.

R.1.2.8 POST-RUN PROCEDURE

1. Open the Control Assembly door, which allows access to the front panel. A light for each channel will indicate which channels, if any, are operating.
2. Remove the sample media as described in Sections R.1.2.6 and R.1.2.7.
3. From the Control Assembly, advance the paper with paper feed switch. Remove the automatic printout for the specific sample. Check the sample number on the display. If they do not match, resolve differences before proceeding. Also, check the printout for start and stop times, start, stop, and average flow rates, volume, and power failures.
4. Send the printout with the filter in the proper mailer. Include site name, operator name, type of sample, type of analysis, air sampler ID, and date shipped.

5. Table R.1.2.1 contains a list of pollutants, filter media, flow rates, run times, start times, and stop times. If the flow rates are not within $\pm 10\%$ and the run time ± 1 hour, then the run should be repeated later on the sixth day particulate sampling schedule, if practical.
6. Next, log in the appropriate data onto the Sampling Log for Toxics (see Figure R.1.2.5). This logsheet is to be returned to the Air Monitoring Manager in your area on a monthly basis.

R.1.2.9

QUALITY CONTROL CRITERIA FOR FILTER SAMPLES

Quality control invalidation criteria for filter samples collected by the XonTech, Model 920 low-volume samplers are listed below. All samples collected in the field are to be checked using these criteria. If a sample does not meet these criteria, the sample is invalid. The sample filter and XonTech printout should still be sent to the laboratory with a clear, concise explanation of the reason for the invalidation. A make-up sample should be collected on the next scheduled PM10/SSI sampling date, if possible, but at least prior to the next scheduled Model 920 sampling date.

1. Filter Contamination - Filters, which are dropped or become contaminated with any foreign matter (i.e., dirt, finger marks, ink, liquids, etc.) are invalid.
2. Damaged or Torn Filters - Filters with tears or pinholes which occurred before or during sampling are invalid.
3. Sample Flow Rate
 - a. If the average flow rate, as printed on the XonTech 920 printout is not within 10 percent of 10.0 LPM, the sample is invalid.
 - b. If the average flow rate, as printed on the XonTech 920 printout exceeds 14.0 LPM, the sample is invalid.
 - c. If the start and stop flow rates, as printed on the XonTech 920 printout differ by more than ± 10 percent, the sample is invalid.

- d. If the average flow rate, as printed on the XonTech 920 printout differs from the start or stop flow rates by more than 10 percent, the sample is invalid.
- 4. Start/Stop Time - Filter samples collected by samplers starting before 2300 hours and after 0100 hours, as indicated by the XonTech 920 printout, are invalid.
- 5. Sample Run Duration - Filter samples collected by samplers which operate less than 23 hours or more than 25 hours, as documented by the XonTech 920 printout, are invalid.
- 6. Power Failure - If a power failure during a sample run causes the stop time or sample duration requirements (#4 and #5 above) to be violated, the sample collected during that run is invalid.
- 7. Sampler Printout - If the sampler printout is not complete or is missing and cannot be retrieved from the sampler, the sample is invalid.

1998 SAMPLING SCHEDULE

North of Tehachapis: 910, 920 (Cr6, TM, HCHO), TSP



Revised by California County Office on 1/2/1996

Figure R.1.2.1
XonTech 920 Sampling Schedule

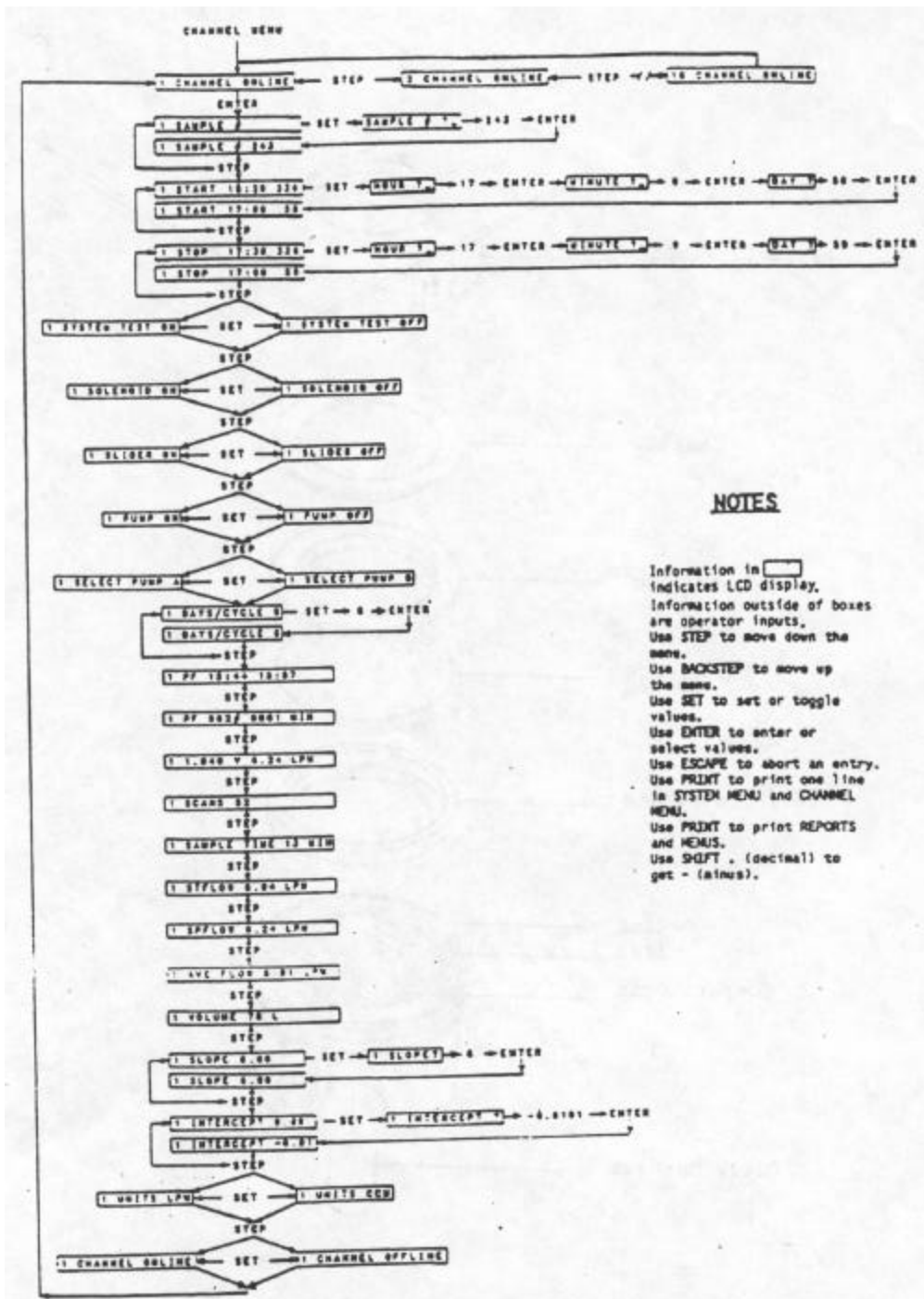


Figure R.1.2.2
Channel Control Guide

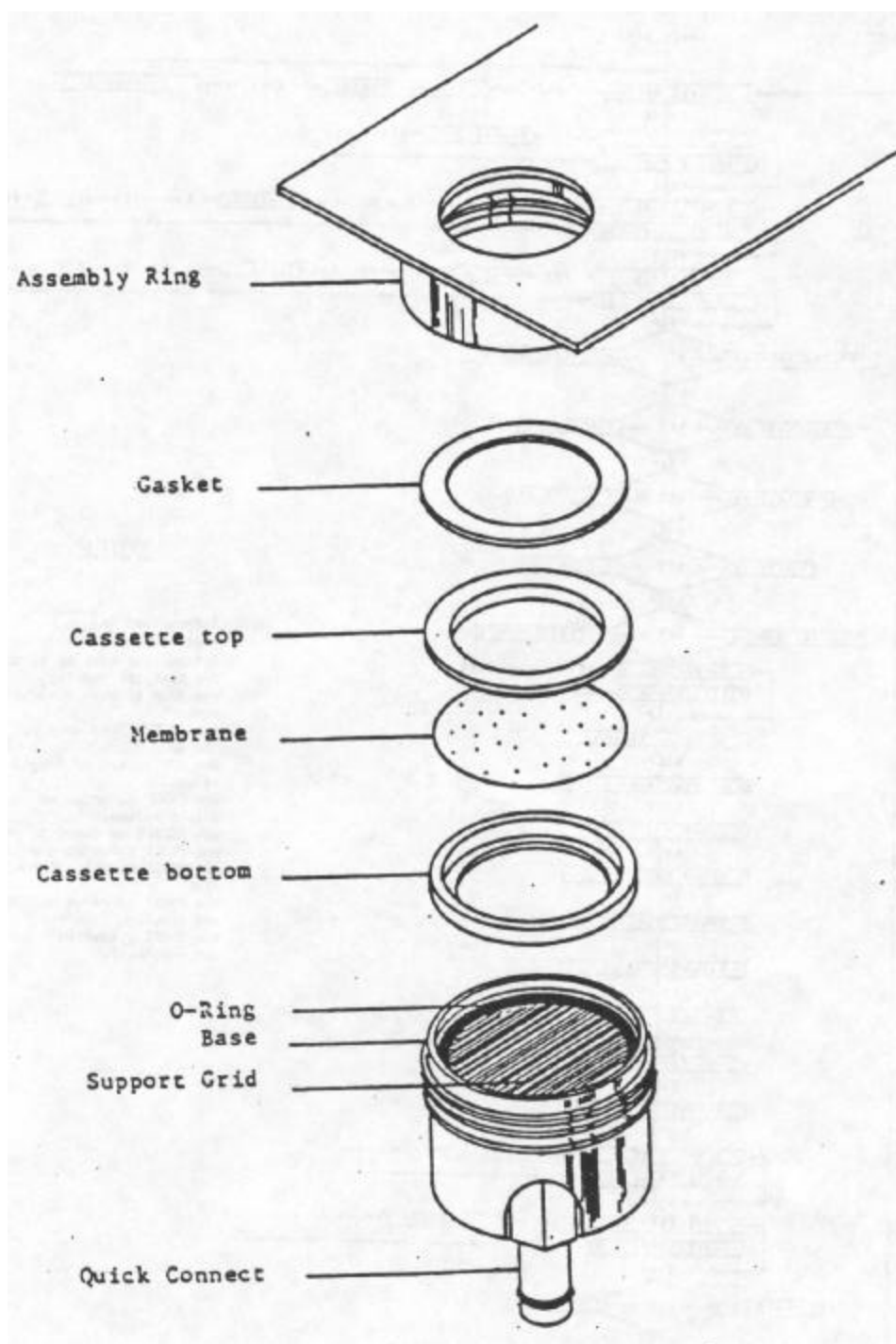


Figure R.1.2.3
Exploded View of the Filter Holder

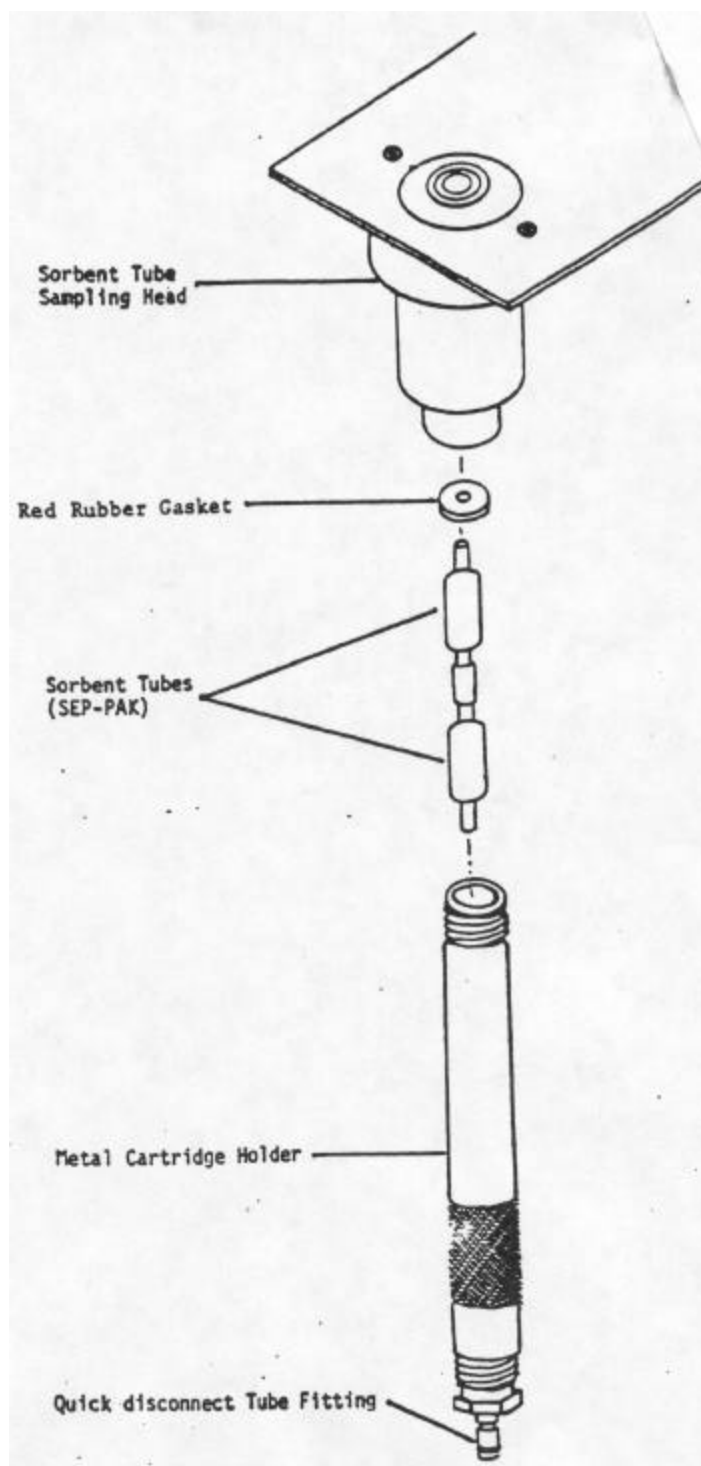


Figure R.1.2.4
Exploded View of the Sorbent Tube Sampling Assembly

[illegible]

Figure R.1.2.5
Sampling Log For Toxics

Table R.1.2.1
Air Toxics Sampling Information Table

<u>Pollutant</u>	<u>Media</u>	<u>Flow Rate*</u>	<u>Run Time</u>	<u>Start Time</u>	<u>Stop Time</u>
CR ⁺⁶	37mm PVC Filter**	10-14 LPM	24 ± 1 Hour	00:01:XXX	23:59:XXX
Total Metals	37mm Teflon Filter	10-14 LPM	24 ± 1 Hour	00:01:XXX	23:59:XXX
Formaldehyde	Sorbent Tubes	0.7 LPM	24 ± 1 Hour	00:01:XXX	23:59:XXX
ABC	Glass Fiber	18-20 LPM	24 ± 1 Hour	00:01:XXX	23:59:XXX

* These values are currant as of 6/91.

** Considering cellulose fiber.

NOTE: For stations, which experience severe fog in the winter, it is advisable that the Cr⁺⁶ and the Total Metals channels be set at flows of 10 LPM.

R.1.3 ROUTINE SERVICE CHECKS

R.1.3.1 GENERAL INFORMATION

Perform the following routine service checks using the attached schedule (Table R.1.3.1) and the procedures documented below and in Section R.1.4. Checks may be performed more frequently but should be performed at least at the prescribed intervals. The Model 920 Quality Control Checksheet (Figure R.1.3.1) should be filled out when the samples are changed and forwarded monthly to the appropriate Air Monitoring Section.

R.1.3.2 EACH RUN

1. Inspect the printer paper. Ensure that enough paper is on the roll for the report(s) to be printed out.
2. Check O-rings or gaskets for placement, resiliency, and cracks.
3. Inspect printer type. Replace the printer ribbon if the type is not clear and distinct.

R.1.3.3 MONTHLY SERVICE

1. Check System Time; the system clock will be set to Pacific Standard Time (PST) ± 2 minutes.
2. Check pressure on vacuum manifolds. The vacuum should be greater than 25 in/Hg.
3. Inspect tubing and power cords for loose connection, kinks, cracks, or other defects. Repair and replace parts as necessary.
4. Ensure that the Control Assembly internal fan operates when the ambient temperature is above 30°C.

R.1.3.4 QUARTERLY SERVICE

1. Clean Control Assembly fan filter.

2. Clean inside Pump Assembly.
3. Clean exteriors.
4. Clean inside Control Assembly.
5. Perform leak test on each sampling channel (see Section R.1.4.1).

R.1.3.5 SEMI-ANNUAL SERVICE

1. Perform calibration of the operating channels.
2. Change pump intake and exhaust filters.
3. Clean MFC screens.
4. Check battery voltage.

R.1.3.6 ANNUAL SERVICE

1. Change memory battery and check voltage.
2. Change clock battery.
3. Note the date when the pump vanes were last changed. Replace them if the last change was more than 30 months or check for wear if the last change is not known. Then label the sampler (on top of the pump) with the new change date.

CALIFORNIA AIR RESOURCES BOARD

MODEL 920 QUALITY CONTROL CHECK SHEET

XONTECH MODEL 920 SAMPLER

Location: _____ Month/Year: _____

Station Number: _____ Technician: _____

Sampler Property Number: _____ Agency: _____

MAINTENANCE TASK	PREVENTIVE MAN. CYCLE	DATE LAST PERFORMED			
Replace Printer Paper	As required				
Replace Printer Ribbon	As required				
Inspect O-Rings + Gasket	Each run				
Inspect System Time	Each run				
Inspect Vacuum Gauge	Monthly				
Inspect Tubing	Monthly				
Inspect Power Cables	Monthly				
Check Control Assembly Fan	Monthly				
Clean Control Box Filter	3 Months				
Clean Exteriors	3 Months				
Clean Inside Pump Box	3 Months				
Clean Inside Control Module	3 Months				
Perform Leak Test	3 Months				
Calibrate Mass Flow Controllers	6 Months				
Change Pump Intake/Exhaust Filter	6 Months				
Check MFC Screens	6 Months				
Change Memory Batteries	1 Year				
Change Clock Batteries	1 Year				
Replace Pump Vanes	30 Months				

COMMENTS: _____

REVIEWED BY: _____ DATE: _____

Figure R.1.3.1
Model 920 Quality Control Checksheet

Table R.1.3.1
920 Sampler Service Schedule

	EACH RUN	MONTHLY	QUATERLY	SEMI- ANNUAL	ANNUAL	30MONTHS
Inspect Paper	X					
Inspect O-Rings or Gasket	X					
Check System Time	X					
Inspect Print Type Quality	X					
Inspect Vacuum Gauge	X					
Inspect Tubing	X					
Inspect Power Cables		X				
Check Control Assembly Fan		X				
Clean Control Assembly Filter			X			
Clean Inside Pump Assembly				X		
Clean Assembly Exteriors				X		
Clean Control Assembly Interior				X		
Perform Leak Test				X		
Change Pump Intake and Exhaust Filters					X	
Clean MFC Screens					X	
Perform Calibration					X	
Change Memory Battery						X
Change Clock Battery						X
Replace Pump Vanes						X

R.1.4 DETAILED MAINTENANCE PROCEDURES

R.1.4.1 CHANGING THE PAPER ROLL

1. Remove the paper roll clear plastic cover by pulling the cover out toward you.
2. Remove the old roll by cutting the paper and then pulling the remaining paper through the printer in a forward direction.

CAUTION: Pulling the paper out in a reverse direction will damage the print mechanism.

3. Press the **POWER** switch on the printer to the OFF position. Push on the left side of the switch.
4. Push down on both sides of the print mechanism cover and remove the cover.
5. Unroll several inches of the paper from the new roll.
6. Cut a straight edge on the paper roll if it is jagged. This will facilitate the entry of the paper into the printer.
7. Slide the paper through the slot connecting the paper compartment and the printer compartment. You can slide the paper in about one-quarter inch before it stops.
8. Press the **POWER** switch to the ON position and wait a few seconds.
9. While holding the paper in place, press the power switch to the PAPER FEED position (push switch to the right). The printer will activate, and a rubber roller will pull the paper into the printer compartment. Hold the switch in the PAPER FEED position until the paper emerges from the top of the printer mechanism. When an inch of paper has emerged from the top of the printer, release the PAPER FEED

button. Now pull the paper through the printer until several inches are exposed.

10. Replace the paper roll cover by sliding it into the slot provided until the cover is against the front panel of the printer.
11. Replace the printer cover by sliding the paper through the slot in the printer cover and reinstalling.

R.1.4.2 CHANGING THE PRINTER RIBBON

1. Press the **POWER** switch on the printer to the OFF position. Push the left side of the switch.
2. Remove the printer cover. It is not necessary to remove the paper.
3. Push down on the right side of ribbon cartridge.
4. Install the new cartridge (slide the ribbon over paper). Be sure paper goes between the ribbon cartridge and the ribbon. Be sure the ink cartridge is inserted firmly to prevent weak or irregular printing. The cartridge must be properly seated and aligned for best printing.

Turn the cartridge "knob" (marked by an arrow) clockwise to stretch the ribbon.

5. Replace the cover.

NOTE: If the ribbon ink gets on the printer plastic case, wipe it off before it dries.

R.1.4.3 CLEANING THE CONTROL ASSEMBLY FAN FILTER

1. Grasp the Fan Filter Cover on the edge that says: **PRY OFF TO REMOVE** and pull down. The cover and filter cassette will come off.
2. Remove the three screens from the cassette.
3. Wash the screens and the cassette and cover with water and detergent.

4. Rinse all the parts and dry them. Replace screens if seriously damaged.
5. Insert the screens so that the corrugations alternate in direction as they are inserted into the cassette.
6. Wipe out the inside of inlet (bottom) of the fan.
7. Install the filter as follows:
 - a. Place the cassette between the two springs on the cover.
 - b. The springs on the cover slide up between two tabs on the metal fan support. Start one spring and compress the other spring and slide the cassette and cover into place.

R.1.4.4 CHANGING MEMORY BATTERIES (B2)

The memory batteries may be changed with the power ON or OFF. There is an advantage to changing the batteries with the power ON; the **memory is not lost.**

1. Open the front panel of the computer.
2. Locate batteries, B2. Depress the battery springs and remove one battery and then the other.
3. Replace with: M Alkaline batteries 1.5 V. Be sure to install the batteries as indicated in the battery holder.
4. If the power is OFF, it will be necessary to go through a cold start.
5. If the sampler fails to return to normal operation (i.e., pump comes on, sliders continue to open and close, unusual display), the problem can usually be corrected by removing all batteries and turning power OFF to clear the memory. A cold start will be necessary if this method is used.

R.1.4.5 CHANGING CLOCK BATTERIES (B1)

The clock batteries may be changed with the power ON or OFF. There is an advantage to changing the batteries with the power ON; the **clock time is not lost**.

1. Open the front panel of the computer.
2. Locate batteries, B1. Depress the battery springs and remove one battery and then the other.
3. Replace with: AA Alkaline batteries 1.5 V. Be sure to install the batteries as indicated in the battery holder.
4. If the power is OFF, it will be necessary to set the clock

R.1.4.6 CHANGING PUMP INTAKE AND EXHAUST FILTERS

1. Turn off the power in the Control Assembly.
2. Disconnect power from the 110 VAC source.
3. Open the pump box.
4. Unscrew the jar from the inlet side (this is usually the cleaner side). Note condition of the cover gasket.
5. Unscrew the end cap and remove the filter cassette. Discard the filter cassette.
6. Clean the jar and end cap with water and detergent. Rinse and thoroughly dry.
7. Wipe the exposed surface with a dry cloth or Kim Wipe to remove excess dirt.
8. Insert a new filter cassette and tighten it into place with the end cap.
9. Install a new cover gasket.

10. Replace the jar and tighten it.
11. Repeat Steps 4-10 for outlet side.
12. Connect the 110 V power and turn on power to resume operation.

R.1.4.7 REPLACING PUMP VANES

1. Turn off the power in the Control Assembly.
2. Disconnect power from the 110 VAC source.
3. Open the pump box.
4. Disconnect the tubing from the tee at the inlet of the pump.
5. Remove both filter jars so they will not be broken.
6. Using a socket wrench, remove the bolts from the end plate on the filter end of the pump.
7. Remove the end plate. (Note the contour and angle of the vanes so the new vanes can be inserted properly).
8. Remove the worn or broken vanes.
9. Blow out or vacuum out the pump chamber (if available, use a small compressed air can). Rotate the motor shaft to be sure that all pieces of the vanes are removed.

NOTE: Sometimes a piece will wedge between the top of the rotor and body. If this is the case, remove the piece by rotating the motor in reverse. Note this information in a logbook. Sometimes this can cause a change in the clearance between the rotor and body. If the pump shows a low vacuum after the vanes are replaced, then the pump will need to be realigned in the shop.

10. Insert four new vanes, making sure that vanes are inserted so they fit the contour of rotor. (Pointed edge out and toward the direction of rotation.)
11. Replace the end cap. Tighten all screws finger tight before cinching down on any of them. Tighten them with a socket wrench.
12. Reinstall the filter jars.
13. Connect the inlet tubing.
14. Connect the 110 V power and resume operation.
15. Check final vacuum/pressure reading.

R.1.4.8 CLEANING EXTERIOR OF SYSTEM

Using soap and water with a sponge, wash the exterior of the pump box, control box, and Sampling Assembly. Do not get water into sample holder assembly. Use a damp rag or sponge. You must keep the slider valve clean and dry. There is nothing to lubricate in any of the assemblies.

R.1.4.9 CLEANING INTERIOR OF THE PUMP ASSEMBLY

1. **AVOID EXTREME DANGER:** Disconnect power.
2. Wipe out the interior of the pump box with a damp rag. Wipe all surfaces, including the pump.
3. Reconnect the power.

R.1.4.10 CLEANING THE INTERIOR OF THE CONTROL ASSEMBLY

1. **AVOID EXTREME DANGER:** Disconnect power.
2. Wipe out the interior of the control box with a damp rag.
3. Reconnect power.

R.1.4.11 LEAK TEST

1. Remove exposed filter or tube from sampling module, if appropriate.
2. Turn on the pump using the sequence of steps given below. The pump motor should be run for at least 10 minutes before leak testing begins. The high and low flow manifold vacuum gauges should have >25 in. Hg vacuum.
 - a. Press **CHANNEL MENU**.
 - b. Press **STEP** to the appropriate channel.
 - c. Press **ENTER**.
 - d. Press **STEP** until the display reads "SYSTEM TEST OFF".
 - e. Press **SET**. The display will read "SYSTEM TEST ON", and the pump will turn on.
 - f. Unplug power cable to slider valve.
3. Change Filter or tube. Install the appropriate pollutant sampling media (see Table R.1.2.1). Use a new filter or tube for this test.
4. Observe normal flow operation.
 - a. Press **STEP** until the display reads "VOLTS/LPM".
 - b. Check Table R.1.2.1 for normal flow rate.
 - c. Troubleshoot if irregularities arise.
5. Leak Test Solenoid Valve.
 - a. Press **BACKSTEP** until the display reads "SOLENOID ON".
 - b. Press **SET** to turn off the solenoid. The display will read "SOLENOID OFF". (Retain same thumbwheel setting).

- c. Press **STEP** until the display reads "VOLTS/LPM".
 - d. Observe the voltage. It updates every 15 seconds.
 - e. The voltage should be <2 percent of the full-scale reading of 5 volts (0.10 volts).
6. Determine "rest voltage" of the Mass Flow Controller. Rest voltage is defined as the voltage of the MFC when the pump is off and there is not any air passing through the MFC.
- a. Press **BACKSTEP** until the display reads "SOLENOID OFF".
 - b. Press **SET**. The display will read "SOLENOID ON".
 - c. Press **STEP** until the display reads "PUMP ON".
 - d. Press **SET**. The display will read "PUMP OFF".
 - e. Press **STEP** until the display reads "VOLTS/LPM".
 - f. Note the voltage. It should be <0.10 volts.
 - g. If voltage is >0.10 volts call shop personnel.
7. Perform Leak Test from Sampling Module to MFC.
- a. Press **BACKSTEP** until the display reads "PUMP OFF".
 - b. Press **SET**. The display will read "PUMP ON".
 - c. Press **STEP** until the display reads "VOLTS/LPM".
 - d. Observe the voltage and LPM. The normal operating flow rate should be on the display at this time.
 - e. Slide the calibration adapter (plugged to prevent flow) on top of the exposed filter or tube orifice and tighten. It may be necessary

to remove the slider, on the slider valve, to get a good seal for the tube sampling subassembly. The slider can be easily removed using an Allen wrench.

CAUTION: Do not over-tighten the calibration adapter. Over-tightening of the adapter can warp the surface plate of the sampling module.

- f. The voltage reading on the display should be <2 percent of full scale (<0.10 volts) with the rest voltage subtracted.
 - g. If the voltage is >0.10 volts, then check all connections (particularly the calibration adapter) and seals for the source of the leak and correct.
8. If calibration is to be performed, go to Section R.3.0, otherwise, loosen the calibration adapter plug (slowly, because the resulting pressure surge may destroy the filter) and remove the calibration adapter from the sampling module.
9. Post Leak Test.
- a. Press **BACKSTEP** until the display reads “SYSTEM TEST ON”.
 - b. Press **SET**. The pump will stop and the display will read “RESET VALUES”.
 - c. Press **ESCAPE**. The display will read “SYSTEM TEST OFF”.
 - d. Enter the outcome on the Model 920 Quality Control Check Sheet Figure R.1.3.1
 - e. Connect power cable to sampling module.
10. Inspect O-rings. Clean the O-rings if they are dirty. Replace the O-rings if they are cracked or damaged, after the leak check.

R.1.4.12 CLEANING MASS FLOW CONTROLLER (MFC) INLET SCREENS

- 1. Disconnect tubing to inlet of MFC on channel being serviced.

2. Unscrew inlet fitting to MFC.
3. Inspect screen on end of fitting for cleanliness and proper attachment.
4. If dirty, rinse with deionized water from squirt bottle. If dirt is persistent, it may be necessary to soak fitting in acetone.
5. If solvent is used, then you must rinse screen with deionized water and dry.
6. Install fitting in MFC and reconnect inlet tubing.

R.1.5 TROUBLE SHOOTING

The following information is a set of precautionary measures to be aware of while servicing the Model 920 Air Sampler. Table S-1 on page 91 of the Operations Manual contains further troubleshooting hints.

R.1.5.1 PUMP SERVICE

CAUTION: NEVER LUBRICATE THIS DRY "OIL-LESS" AIR PUMP. The carbon vanes and grease packed motor bearings require no oil.

Construction: The outer end plate, body, rotor, and mounting bracket are all cast iron. Consequently, any moisture that accumulates in the pump will tend to corrode the interior when the pump stands idle. The vanes are made of hard carbon and are precision ground. They should last 5,000 to 10,000 hours (on a 12-day sampling schedule this translates to 6 to 12 years) depending upon the amount of vacuum at which the pump is operated.

NOTE: The motor is thermally protected and can automatically restart when the protector resets. Always DISCONNECT power source before servicing. Personal injury and/or property damage could result.

Filters: Dirty filters restrict airflow and, if not corrected, could lead to possible motor overloading and early pump failure. Check filters periodically and replace when necessary.

Flushing: Should excessive dirt, foreign particles, moisture, or oil be permitted to enter the pump, the vanes will act sluggish or even break. Flushing of the pump should take care of these situations. In order to flush a pump, remove the filter and muffler assemblies, and introduce several teaspoons full of solvent* into the pump through the intake WHILE THE PUMP IS RUNNING. Flush unit in a well-ventilated area. Eye protection is recommended. Keep face away from exhaust port and do not flush unit with flammable solvent. Repeat the flushing procedure, and if it does not remedy the situation, remove the end plate for further examination.

*Recommended Solvent: Gast Flushing Solvent Part AH255.

CAUTION: DO NOT USE KEROSENE, GASOLINE, OR ANY FLAMMABLE LIQUID.

Disassembly: If flushing does not eliminate the problem, remove the six bolts holding the end plate to the body. Now remove the end plate and the four vanes (DO NOT REMOVE THE ROTOR OR LOOSEN ANY ELECTRIC MOTOR "THRU-BOLTS".) If the pump fails to produce the proper vacuum or pressure, the vanes could be worn. A metallic clanging could mean the rotor and body are touching. The top clearance may be adjusted by "lightly" tapping on the pump body (either top or bottom depending upon whether clearance is too large or small). The rotor should be turned while setting clearance to assure that all points on the rotor clear the body. End clearance for the drive end is .0015 and .003 inches for the dead end.

R.1.5.2 PRINTER SELF TEST

The print head and ribbon can be tested only after inserting paper. Do not print without paper. To perform the test, follow these steps:

1. Assure ON-OFF switch is in the OFF position.
2. Plug in power source to printer.
3. Depress ON-OFF switch until the printer reaches paper feed position.
4. Hold switch in paper feed position until LED light goes on and printer starts to operate. Release switch.
5. There are two ways to stop the printer:
 - a. Turn ON-OFF switch to OFF position during printing operation. Wait about three seconds and depress ON-OFF switch to ON. Printer is now ready.
 - b. Allow printing to continue until it stops automatically.

R.1.5.3 SLIDER VALVE

The slider valve mechanism consists of a motor driven gear mechanism, which turns a cam. The cam actuates two micro switches as it drives the slider valve open and closed. A nylon set screw is used to connect the camshaft to the motor drive.

CAUTION: Do not replace the nylon screw with a metal screw. The drive is very strong and something needs to give in the event that a finger is caught in the slider valve when it is moving.

If the nylon set screw becomes loose, it will become necessary to tighten or replace it.

1. Remove the Sample Holder Assembly from the Sampling Assembly.
2. Remove the slider cover plate and note the orientation of the slot for reassembly (it is off center).
3. Rotate the motor shaft counter clockwise until the screw is exposed.
4. Tighten or replace screw.
5. Replace the cover plate with the slot in the same orientation as above.
6. Install the Sample Holder Assembly.

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APPENDIX R.2.0

ACCEPTANCE TEST PROCEDURE FOR THE
XONTECH 920 AIR SAMPLER

MONITORING AND LABORATORY DIVISION

JUNE 1991

R.2.0 ACCEPTANCE TEST PROCEDURE

R.2.0.1 GENERAL INFORMATION

Before beginning acceptance testing of the XonTech Model 920 multichannel sampler, read the manual thoroughly. Then, initiate an acceptance test log and an acceptance test report. Record the dates of the individual tests, problems, contacts with the manufacturer, and any other pertinent information on the acceptance test log.

R.2.0.2 PHYSICAL INSPECTION

Unpack the XonTech 920 and check for physical damage and that the sampler is complete, if this has not already been done. Record the MFC serial numbers on the Acceptance Test Datasheet, Figure R.2.0.1.

1. Verify that the sampler comes with two copies of the operating and service manual.
2. Visually verify that the cabinet and all connections, which may be exposed to the elements, are weatherproof. Assemble the legs to the sampling head and connect any external parts necessary to complete the acceptance test procedure.
3. Open cabinet door and loosen captive panel mounting screws when necessary to perform the following checks:
 - a. Check for correct power cord phasing; standard wiring configuration has the black wire connected to the brass terminal of the plug, white to the copper terminal, and green to earth ground. Check internal wiring to assure that all other wiring is secure.
 - b. Check to see that all integrated circuits, plugs, and other connectors are properly seated in their mating receptacles.
 - c. Complete assembly of any internal and accessory parts required to perform the acceptance test. (Install the inlet sampling head and leave installed for chamber testing.)

- d. Verify four each AA size Alkaline batteries are installed in the memory and clock circuits labeled B1 and B2.

R.2.0.3 OPERATIONAL CHECKS

Refer to the XonTech 920 manual for proper operation of the required acceptance test steps, and to check performance of the operational results. During chamber tests, connect a strip chart recorder to the reference mass flow meters external of the chamber to assure proper Operation of the Model 920 mass flow controllers. Recorder charts should be cut into 24-hour segments and labeled at the bottom with the following:

Test performed (across bottom of chart)

Date

Make, model number, and serial number of 920 sampler under test

Range on which test is performed

Recorder trace color identification, if appropriate

Recorder identification

Clear, precise notations should be entered on the chart indicating when the tests were started and ended, pertinent information regarding sample flow, voltages, temperatures, etc., and any unusual conditions observed. Charts and 920 sampler print outs should be attached to the final acceptance reports.

Perform the following operational checks and record the results on the test report.

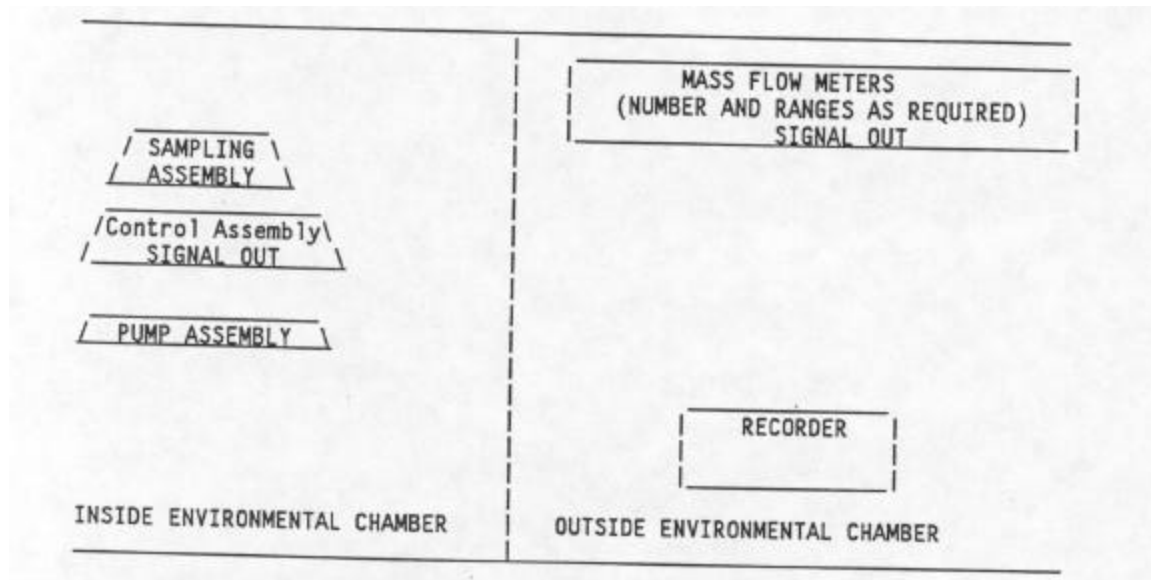
1. When satisfied that the 920 sampler is completely assembled and meets all physical specifications, turn on the main power switch. Follow the manufacturer's manual procedures for a Cold Start.
 - a. Use the self-test procedures to verify the battery voltages.
2. Use the manufacturer's manual to perform the following performance checks and check them off as they pass or fail on the Acceptance Test Datasheet.
 - a. Power Failure: Kill power to the unit and leave off for at least five minutes. Reconnect the power and verify that the 920 sampler restarts correctly following the Warm Start procedure.

- b. Channel Programming Performance: Program channels 1 through 8 and verify that the program is entered and functions properly.
- c. Display Unit: Verify that all segments of display operate properly during self-test.
- d. Printer Unit: Verify proper operation of printer by performing printer self test.
- e. Slider and Solenoid Function: Manually operate each channel and verify **ON and OFF** function of solenoids and for smooth and complete opening and closing of sliders.
- f. Leak Check: Check Channels for plumbing leaks following Quality Assurance Manual Procedures (see Section R.1.4.12).
- g. Memory Backup: Verify that when the unit power is interrupted for seven days or more, that the battery maintains memory.
- h. MFC Attitude Check: Verify that when the MFC's are rotated 45 degrees in any direction from their normal position that their readings remain stable.
- i. MFC Linearity Test: Check each mass flow controller at 100, 75, 50, 25, and 10 percent of full scale against a certified mass flow meter of the proper range. Each point should be within 1 percent for acceptable linearity. Record all linearity check results on standard calibration forms and attach the completed forms to the final report.
- j. Perform the power supply self test to verify ± 5 VDC and 12 VDC. Record the voltages on the Acceptance Test Datasheet.

R.2.0.4

ENVIRONMENTAL CHAMBER OPERATIONAL TESTS

1. Temperature and Voltage Stability - Set up the 920 sampler in the environmental chamber. Connect certified MFM's placed outside of the chamber to the channels under test as shown in the diagram on the next page. Keep the tube length from the Model 920 to the MFM's as short as possible.



2. With the 920 sampler operating, run a temperature/voltage test using Thermotron controller program ranging from 1 to 55 degrees C.
 - a. Record the airflow into each channel during the test with a MFM and recorder which are outside of the chamber. The sample flow rate shall not change by more than ± 1 percent per degree Centigrade.
 - b. Reliability Testing: Verify that the Model 920 operates properly with no malfunctions of any component part during the chamber testing, such as microprocessor, printer, and displays.

R.2.0.5 POST ACCEPTANCE TEST

1. Confirm that all recorder charts are properly labeled, the test report is complete, and the 920 sampler meets or exceeds all specifications. Give the test package (test report, recorder charts, log) to the project coordinator for review.
2. After the test results have been reviewed and accepted, contact the Administrative Services Division's property clerk to have a property number assigned and attached to the sampler, complete a move tag, and turn the completed unit over to the stock clerk.

Figure R.2.0.1
Acceptance Test Datasheet

3. Environmental Chamber Test

XonTech MFC Information			Certified MFM Information		
Manufacturer	Range	S/N	ARB #	Range	Expiration Date

Temperature and Voltage Stability

35°C, 115V
35°C, 125V
35°C, 105V
15°C, 115V
15°C, 125V
15°C, 105V

% Dev	Pass	Fail	Final

Attach run results and calculations to final report.

4. Comments/Maintenance and Repairs Performed:

Attach additional sheets if necessary.

Figure R.2.0.1
Acceptance Test Datasheet (cont.)

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CALIBRATION PROCEDURE FOR THE
XONTECH 920 AIR SAMPLER

MONITORING AND LABORATORY DIVISION

JUNE 1991

R.3.0 CALIBRATION PROCEDURE

R.3.0.1 OVERVIEW

The mass flow controllers (MFCs) inside the XonTech 920 Control Assembly are calibrated using flow transfer standards that have been certified against a primary flow standard. The certification of the transfer standard is referenced to 25 EC and 760mm Hg. Since the flow transfer standard is a mass flow meter (MFM) the calibration does not have to be corrected for altitude or temperature.

One to three calibrations of the MFC are performed against the flow transfer standard. The initial calibration is as is to verify previously collected data. The second calibration, final, is performed if leaks were corrected or other maintenance performed. The third calibration, confirmation, is performed after new slope and intercept data are input into the 920 microprocessor.

R.3.0.2 APPARATUS

1. Transfer standard mass flow meters:
Ranges: 0-3 SLPM and 0-30 SLPM
2. 1/4 inch + 3/8 inch Teflon tubing
3. Calibration adapter
4. 2 adjustable wrenches (6 inch)
5. 1/4 inch + 5/16 inch brass plugs
6. Spare O-rings
7. New filters, cassettes and tubes
8. Calibration report forms
9. 1/8 inch Allen wrench
10. Calculator capable of performing linear regression curve fitting.

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CALIBRATION PROCEDURE FOR THE
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R.3.1 CALIBRATION

R.3.1.1 AS IS CALIBRATION

Other than routine daily checks, sampler repairs or adjustments should not be made prior to the as is calibration. The sampler should be calibrated after six months of operation, if the sampler is moved to a different site, or if the initial falls outside of the specified tolerance limits (see Table R.1.2.1).

1. Lift the sampling assembly hood and tilt it in the direction that allows access to the sampling module in need of calibration. Remove the existing filter or tube (if one is currently installed) and replace with an unexposed filter or tube.
2. Turn on the pump using the sequence given below. The pump motor should run for at least 10 minutes before the calibration beings. The high- and low-flow manifold gauges should have >25 in. Hg vacuum.
 - a. Press **Channel Menu**.
 - b. Press **Step** to the appropriate channel.
 - c. Press **Enter**.
 - d. Press **Step** until the display reads "System Test Off".
 - e. Press **Set**. The display will read "System Test On", and the pump will turn on.
 - f. Unplug the power cord to slider valve motor.

NOTE: The slider valve for the absorbent tube must be removed to properly seal calibration adapter.

- g. Install calibration adapter. Try to ensure a leak free seal in the adapter set up. Do not correct other leaks at this time. A complete leak check with repairs will be done after the as is calibration.

3. Connect the certified MFM to the sampling module, if XonTech style adapter is used. The large O-ring on the calibration adapter will seal the filter sampling ports, and the small Oring will seal the tube inlet when the slider valve involved. If the ARB adapter is used, it is placed in the filter holder in place of the plastic cassette. Install the appropriately sized Teflon tubing between the MFM and the calibration adapter. Tighten all compression fittings (i.e., Swagelok) 1/4 turn past finger tight. Plug in and turn on the MFM.
4. Fill out the XonTech 920 Calibration Form (Figure R.3.1.0) as completely as possible. Enter date, pollutant, sample property number, site name, site number, transfer standard certification information, as is information, etc.
5. After the sampler has warmed up:
 - a. Press **Step** until the display reads "Voltage/LPM".
 - b. With the thumbwheel set to the as is set point, record the transfer standard display, thumbwheel setting, volts display, and flow rate display after the readout has stabilized.
 - c. Advance the thumbwheel setting by 5-101 of full scale and record the average volts and flow rate on the XonTech 920 Calibration Form after the 920 display has stabilized.
 - d. Repeat Step 3 until 2 points are collected above the as is thumbwheel set point and 2 points are collected below the as is set point.
6. Return system to standby.
 - a. Press **Backstep** until the display reads "System Test On".
 - b. Press **Set**. The pump will stop and the display will read "Reset Values".
 - c. Press **Escape**. The display will read "System Test Off".

R.3.1.2 LEAK TEST

1. Perform leak test as stated in Section R.1.4.11.
2. Repair leaks as needed.

R.3.1.3 FINAL CALIBRATION

NOTE: For stations which experience severe fog in the winter, it is advisable that the Cr^{+6} and the Total Metals channels be set at flows of 10 LPM.

A final calibration is required after maintenance is performed that would affect the flow path of the sample air, after installation of the sampler or replacement of the control assembly or flow module. Perform the final calibration, if required, using the same procedures as used in the “as is” calibration. Using the data obtained (voltage displayed vs. standard flow), calculate the new slope and intercept and program the new values into the channel menu.

R.3.1.4 CONFIRMING CALIBRATION

A confirming calibration is required if the new slope and/or the intercept values are entered into the 920 microprocessor. The confirming calibration compares the standard flow rate calculated from the flow transfer standard with the flow rate display of the 920. The confirming calibration must have a slope of 1.00 ± 0.01 and intercept of less than 0.5 percent of the MFC full scale flow rate.

At the conclusion of all calibrations, remove the calibration adapter and plug in the power cord to the slider valve motor.

XONTECH 920 CALIBRATION FORM

[illegible]

Figure R.3.1.0
XonTech 920 Calibration Form

R.3.2 CALCULATIONS

The final calibration or the as is calibration (if a final calibration is not required) must have a correlation coefficient greater than 0.999. The comparison between the standard flow rate and the 920 flow rate display (confirming calibration) must have a slope of 1.00 ± 0.01 and an intercept of +0.5 percent of full scale (± 0.15 LPM for a 30 LPM full-scale flow rate). If the confirming calibration data do not meet these specifications, maintenance, and/or another final calibration must be performed, a new slope and intercept entered into the 920 microprocessor, and another confirming calibration performed.

R.3.2.1 DETERMINATION OF STANDARD FLOW RATES

Multiply the transfer standard display values by the transfer standard certification slope and add the intercept to obtain the standard flow rate values for the as is, final, and confirming calibrations. Record values on the XonTech 920 Calibration Form (Figure R.3.1.0).

R.3.2.2 AS IS LINEAR REGRESSION

Perform a linear regression calculation on the as is voltage display and the as is standard flow rates. Record the slope, intercept and correlation coefficient.

R.3.2.3 FINAL LINEAR REGRESSION

Calculate the linear regression for the final voltage displays and the standard flow rates. Record the slope, intercept and correlation coefficient. Enter the slope and intercept values into the proper channel.

R.3.2.4 THUMBWHEEL SET POINT

Determine the correct thumbwheel set point by either performing a linear regression of standard flow rate versus set point or adjusting the thumbwheel with channel in normal operation to get the desired display flow rate.

R.3.2.5 CONFIRMING CALIBRATION

For the confirming calibration, perform a linear regression analysis of standard flow rate versus 920 flow rate display. The slope and intercept must meet the requirements of Section R.3.2.

R.3.2.6 PERCENT DEVIATION FROM PREVIOUS CALIBRATION

Determine the percent deviation from the previous calibration using the following calculation:

$$\frac{S1 - S2}{S2} \times 100 = \% \text{ Deviation}$$

where,

S1 = the previous flow rate determined by using the as is thumbwheel setting with the final slope and intercept values from Section R.3.1.2.

S2 = the final flow rate determined by using final thumbwheel setting with the final slope and intercept values from Section R.3.1.2.

Enter the value on the XonTech 920 Calibration Form.

R.3.2.7 CALIBRATION REPORTING INSTRUCTIONS

Complete the XonTech 920 Calibration Form (see Figure R.3.1.0). Send in to the instrument files. Return a copy to the sampling site for inclusion in the station file.

R.3.2.8 BLANK FORMS AND ASSISTANCE

A supply of blank XonTech 920 Calibration Forms, as well as assistance in calibration procedures, can be obtained by contacting:

STATE OF CALIFORNIA
Air Resources Board
Monitoring and Laboratory Division
Air Quality Surveillance Branch
P.O. Box 2815
Sacramento, CA 95812